

SERVICE MANUAL

FOR

MPC

Marine Pressure Calibrator
all standard models



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SERVICE MANUAL MPC

This Manual applies to calibrators. Type: MPC XXX BAR

From serial no.: XXXXXX-00001

For special calibrators, please contact the factory.

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1.1 INTRODUCTION

All pressure calibrators are produced from quality components by skilled staff.

Each pressure calibrator passes several tests during assembly and is finally inspected and tested, following a special calibration procedure laid down by our technical management.

The performance of each pressure calibrator should apply for a minimum of one year as from date of using the instrument in general service.

If you decide to check and/or re-calibrate the pressure calibrator, always use certified test equipment only and secure proper contact between your test probe and the well of the calibrator.

The following test and repair information has been issued to the best of our knowledge at the time of issue, but if you have further questions, please never hesitate to contact us:

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The operation and technical specifications are stated in the user manual:

**USER MANUAL
FOR
Marine Pressure Calibrator
MPC-15
&
MPC-140**

Order no.: 102256

1.2 ELECTRICAL DESCRIPTION

Please see drawing Block diagram, No. 100315.

The battery <A> is connected to the power unit , which supplies all the other circuits.

The microprocessor <C> is able to pull down the power unit . The processor is linked directly to the display <E>, keyboard <F> and A/D-converter <H>. It also controls the signals to the visual alarm unit <G> and the peak detection unit <O>. The processor also has a serial communication, which can be used for RS232 if a voltage adapter is used.

The visual alarm unit <G>, which consists of a beeper and a LED, is controlled by the processor <C>.

The watch dog unit <D> gives an indication to the processor <C> if the power signal is bad and thereby resets the calibrator.

The switch input unit <I> gives an indication to the processor <C> if the sensor is open or closed.

The 20 bit A/D-converter <H> receives the input signal from an analog switch <J> and compares the signal to the reference voltage unit <K>.

The analog switch <J> has 8 inputs, mean pressure signal <N>, mA signal <P>, Vref <K>, ground reference, negative and positive peak signal <O>, temperature signal <R> and volt signal <Q>.

The voltage reference unit <K> gives a stabile low drift voltage to the A/D-converter <H>, the analog switch <J> and the power source to the transducer <L>.

The power source to the transducer <L> can give a current or voltage supply to the transducer <M>.

The transducer signal is amplified in the amplifier <N> and because the signal is measured 2 times each second, a peak detection unit <O> is used. The processor <C> resets the peak unit <O> when needed.

The current conversion unit <P> converts the current to the internal signal range for the A/D-converter <H>.

The voltage conversion unit <Q> converts the signal voltage to the internal signal range for the A/D-converter <H>.

The temperature unit <R> gives a signal which is used for the internal temperature software compensation.

2.1 SOFTWARE CALIBRATION PROCEDURE

The calibration procedure consists of 2 calibration points; a high and low value for interpolation, except the pressure calibration, which consists of 6 points in order to compensate for nonlinearity of the transducer. The pressure calibration is made in BAR, but can be done in PSI if the unit is selected before the calibrator is switched OFF (See User Manual, section 4.0 - Operation).

General functions.

In the calibration menus, 4 of the softkeys have a different function. The 4 keys are:

Softkey	Function
mA/V	Activate for next digit. The digit for changing is indicated by a blinking cursor.
Mean/Peak	Decrease the selected digit.
Zero	Increase the selected digit.
Units	Enter the value, and go to next point.

Safety precaution.

To reduce risks for errors when entering the interpolation points a safety precaution is built into the software. The safety precaution only accepts the next calibration point if it differs and with a higher value from the previous entered calibration point.

Digital value.

The digital value will be shown in the display during the calibration. This is to enable visual inspection that the input signal is stable and can be utilized as a calibration point. However, the resolution is so high that the digital input value can change +/-10 digits during a period of 30 seconds on a stable input signal.

Digital signal for 0.

Since the calibrator works both on positive and negative input signals, the digital signal for 0 will typically lie between 500000 and 550000.

Start calibration mode.

In order to start the calibration mode you have to press down two keys at the same time and then press the <ON/OFF> key. See the table below for which keys to press in order to do a specific calibration.

Note: UM = User Manual.

<u>Calibration</u>	<u>Keys:</u>	<u>Page</u>
Pressure (standard)	<Mean/Peak> & <Hold-Reset>	2/5
Pressure (user)	<Mean/Peak> & <Zero>	Section 5.2 (UM)
Temp. comp. low	<Units> & <mA/V>	4/5
Temp. comp. high	<Units> & <Hold-Reset>	5/5
mA (0 and 50)	<Mean/Peak> & <mA/V>	Section 5.3 (UM)
V (0 and 30)	<Mean/Peak> & <Unit>	Section 5.4 (UM)

2.1.1 Calibration CODE access procedure

To make sure that only authorized personnel has the possibility to make the standard calibration, a safety CODE procedure is entered in the calibration procedure.

When the display shows "SELF-CALIBRATING" release the softkeys which were activated. Then the display will show following message:

ENTER CODE:

The user CODE is <Units> <Units> <Zero> <Mean/Peak>.

Then the internal temperature will be shown in °C in the first line of the display.

TEMP: 25.1

The absolute accuracy for the temperature can be 3°C wrong. Since the calibrator only uses the relative signal for compensation, just note the temperature in the display. The compensation accuracy is depended of the long term stability only.

In order to proceed the calibration procedure, press the softkey <Reset-Hold>.

2.1.2 Standard pressure calibration

The pressure source should be traceable and calibrated within the last 12 month and have an accuracy of 0.01% of Full Scale.

Connect the pressure source to the calibrator. Set the pressure to 0 BAR / 0 PSI.

In order to start the pressure calibration, switch off the calibrator. Press and hold down the <Mean/peak> and <Hold-Reset> softkeys at the same time and switch on the calibrator. Enter the CODE, note the temperature and press <Hold-Reset>.

Then the display will show one of following (BAR or PSI):

BAR:

0%:_ 0.0000BAR
IN: 524288

PSI:

0%:_ 0.000PSI
IN: 524288

Press <Units> for entering the first value.

20%:_ 0.0000BAR
IN: 524288

20%:_ 0.000PSI
IN: 524288

Set the pressure to 20 % of full scale.

20%:_ 0.0000BAR
IN: 608174

0%:_ 0.000PSI
IN: 608174

Enter the exact value by using the special softkeys.

Repeat this procedure for 40%, 60%, 80% and 100% of full scale. When <Units> is pressed for 100% the values are stored and the calibrator goes back to normal operation.

20.000 BAR
0.000mA-25.00%L

290.08 PSI
0.000mA-25.00%L

Then remove the pressure and disconnect the pressure source. The calibrator then has to be temperature compensated.

2.1.3 Temperature compensation low temp.

Insert the calibrator in a temperature box with a delta on at least 10°C lower than the ambient temperature. It is recommended to calibrate at approx. 5°C. Connect the pressure source to the calibrator. Set the pressure to 0 BAR / 0 PSI.

In order to start the temperature calibration, switch off the calibrator. Then press and hold down the <Unit> and <mA/V> softkeys at the same time and switch on the calibrator.

If the temperature delta is less than 10°C an error message occurs. If the delta is OK then enter the CODE, note the temperature and press <Hold-Reset>.

Then the display will show one of following (BAR or PSI):

BAR:

0%:_ 0.0000BAR
IN: 524288

PSI:

0%:_ 0.000PSI
IN: 524288

Press <Unit> for entering the first value.

100%:_ 0.0000BAR
IN: 524288

100%:_ 0.000PSI
IN: 524288

Set the pressure to 100 % of full scale.

100%:_ 0.0000BAR
IN: 943718

100%:_ 0.000PSI
IN: 943718

Enter the exact value by using the special softkeys.

When <Unit> is pressed for 100% the values are stored and the calibrator goes back to normal operation.

20.000 BAR
0.000mA-25.00%L

290.08 PSI
0.000mA-25.00%L

2.1.4 Temperature compensation high temp.

Insert the calibrator in a temperature box with a delta on at least 10°C higher than the ambient temperature. It is recommended to calibrate at approx. 45°C. Connect the pressure source to the calibrator. Set the pressure to 0 BAR / 0 PSI.

In order to start the temperature calibration, switch off the calibrator. Then press and hold down the <Unit> and <Hold-Reset> softkeys at the same time and switch on the calibrator.

If the temperature delta is less than 10°C an error message occurs. If the delta is OK then enter the CODE, note the temperature and press <Hold-Reset>.

Then the display will show one of following (BAR or PSI):

BAR:

0%:_ 0.0000BAR
IN: 524288

PSI:

0%:_ 0.000PSI
IN: 524288

Press <Unit> for entering the first value.

100%:_ 0.0000BAR
IN: 524288

100%:_ 0.000PSI
IN: 524288

Set the pressure to 100 % of full scale.

100%:_ 0.0000BAR
IN: 943718

100%:_ 0.000PSI
IN: 943718

Enter the exact value by using the special softkeys.

When <Unit> is pressed for 100% the values are stored and the calibrator goes back to normal operation.

20.000 BAR
0.000mA-25.00%L

290.08 PSI
0.000mA-25.00%L

Then remove the pressure and disconnect the pressure source and the calibrator is ready for use.

3.1 TROUBLE SHOOTING

The software program will do automatic checks of the hardware signals. It also performs a simple check of the calibration points. Following messages can occur during an error condition.

Message	Cause	Action
CS-ERR IN EEPROM RE-CALIBRATE	Bad calibration	Re-calibrate calibrator
OVERRANGE	The software has to show more than 6 digits readout for the input signal.	Check the mA/V input circuit.
PRESSURE IS OUT OF ZERO RANGE.	The range for zero offset is exceeded.	If the message occurs with zero pressure, change the transducer and re-calibrate it.
LOW BATTERY PRESS ANY KEY	The battery voltage is below 7 Volts.	Change battery.
TEMP. ERROR	Too low deviation for the temperature in calibration.	If temperature deviation is OK, then replace sensor and re-calibrate.
ENTER CODE	Producer calibration protection.	Enter code: <Unit><Unit><Zero><Mean>
ERROR	The input signal or the value are the same for the next calibration point.	Make sure that both the input signal and value are altered.
SELF-CALIBRATING	Only shown when the calibrator is switched on.	Release the button.
SELF-CALIBRATING AND ZERO-SETTING	Message after zero offset activation.	
STANDARD CALIBR. SELECTED	Selection of producer calibration.	
USER CALIBRATION SELECTED	Selection of user calibration.	
OVERPRESSURE	Pressure 20 % higher than the calibration range.	
OUT OF RANGE	Less than 50 LSB from the input span of the ADC.	

3.1 TROUBLE SHOOTING, cont.

Message	Cause	Action
Pressure measurement is not responding or not correct	The temperature sensor is damaged	Check the temperature sensor. (Enter calibration mode, but switch off the unit when the temperature has been shown in the display). If the sensor is damaged, replace the sensor and re-calibrate pressure.
	Transducer error	If temperature sensor is OK, then replace transducer and re-calibrate the pressure.
Signal measurement is not responding or not correct	Cable error	Check cable from terminals to filter PCB
	Filter PCB error	Check filter PCB
calibrator does not respond on keyboard operation	Keyboard error	If the cable and filter PCB are in order, replace main board and make a complete re-calibration
		Check the keyboard (and cable)
Display shows incorrect or no characters	Display error	If the keyboard is in order, replace main board and make a complete re-calibration
		Check display (and connector)
		If the display is in order, replace main board and make a complete re-calibration

3.2 REPLACEMENT OF THE TRANSDUCER

Change the transducer!

See Exploded view.

Unscrew the 4 screws (ref.24) (Tool: PZD Gr.1) and remove the battery part (ref.21). Disconnect the battery connector (ref.20) and the connector from the transducer. Unscrew the screw (ref.26)(Toll: hexagon key 2.5) and remove the bracket (ref. 27). Unscrew the 2 screws (ref.19) (Toll: PZD Gr.2) and remove the manifold (ref.15) with the transducer. Unscrew the transducer nut, dismount the connector and replace the transducer.

Reassemble it in reverse order.

Please note! Be sure that the cover plate (ref.16) is on the outside of the box and coat the diode (ref.25) with cool compound.

Remove RD2 on the Resistor platform (ref. 11). Connect a decade box on J12. Connect a voltmeter to TP1(-) and TP3 (+). Set pressure on the transducer and find the resistor value on the decade box so that the signal is 2 V for 100 % pressure. Find the nearest value for the resistor RD2 in the E192 table. Mount and solder the resistor in the Resistor platform. Then recalibrate the calibrator for pressure and temperature compensation (see doc. no. 100313).

3.3 CPU REPLACEMENT OR PROGRAM DOWNLOADING

If there is made a new or special version of the software to calibrator, the CPU (IC3) has to be replaced. The CPU is normally programmed by AMETEK, but can be programmed by the customer.

For replacement, just remove the old one and insert the new one in the socket.

NOTE: Be sure that the pins at the corners of the IC are not touching each other.

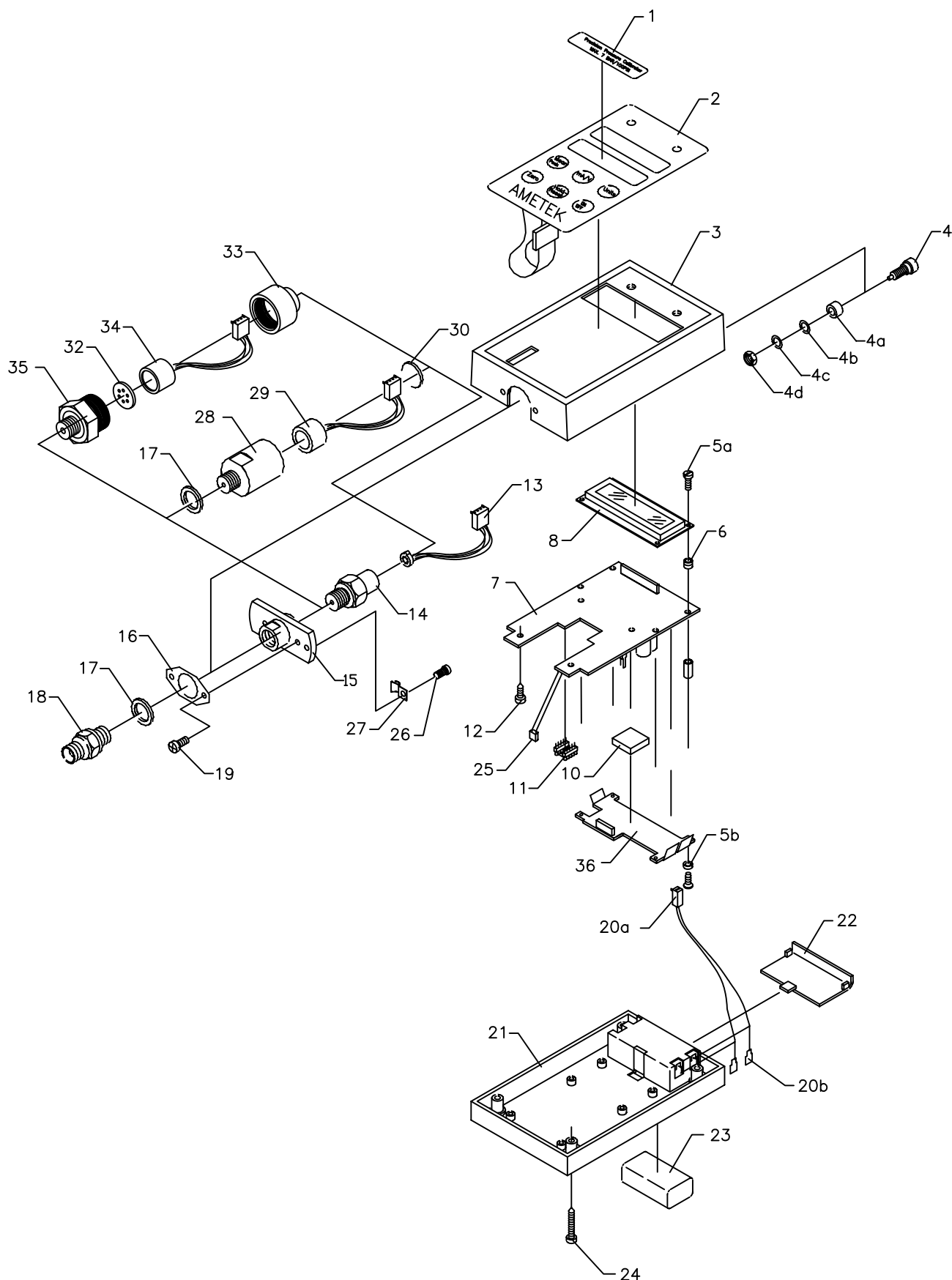
When the IC is replaced then recalibrate the calibrator. The pressure calibration with temperature compensation is shown in this manual, section 2.1, doc. no. 100313, the current calibration in the User Manual, section 5.2 and the voltage calibration in the User Manual, section 5.4.



It is also possible to download the new software to a new (erased) processor. The processor is a MC68HC711E9. However, the processor can not operate on the standard interface RS232C. In order to run on the RS232C interface you have to use a voltage adapter. This adapter can be supplied by AMETEK with a standard cable to the PC. In order to download the software "PPC.LO" you have to use a download program "PROM.EXE". Both files will be supplied on a 3½" floppy disk.

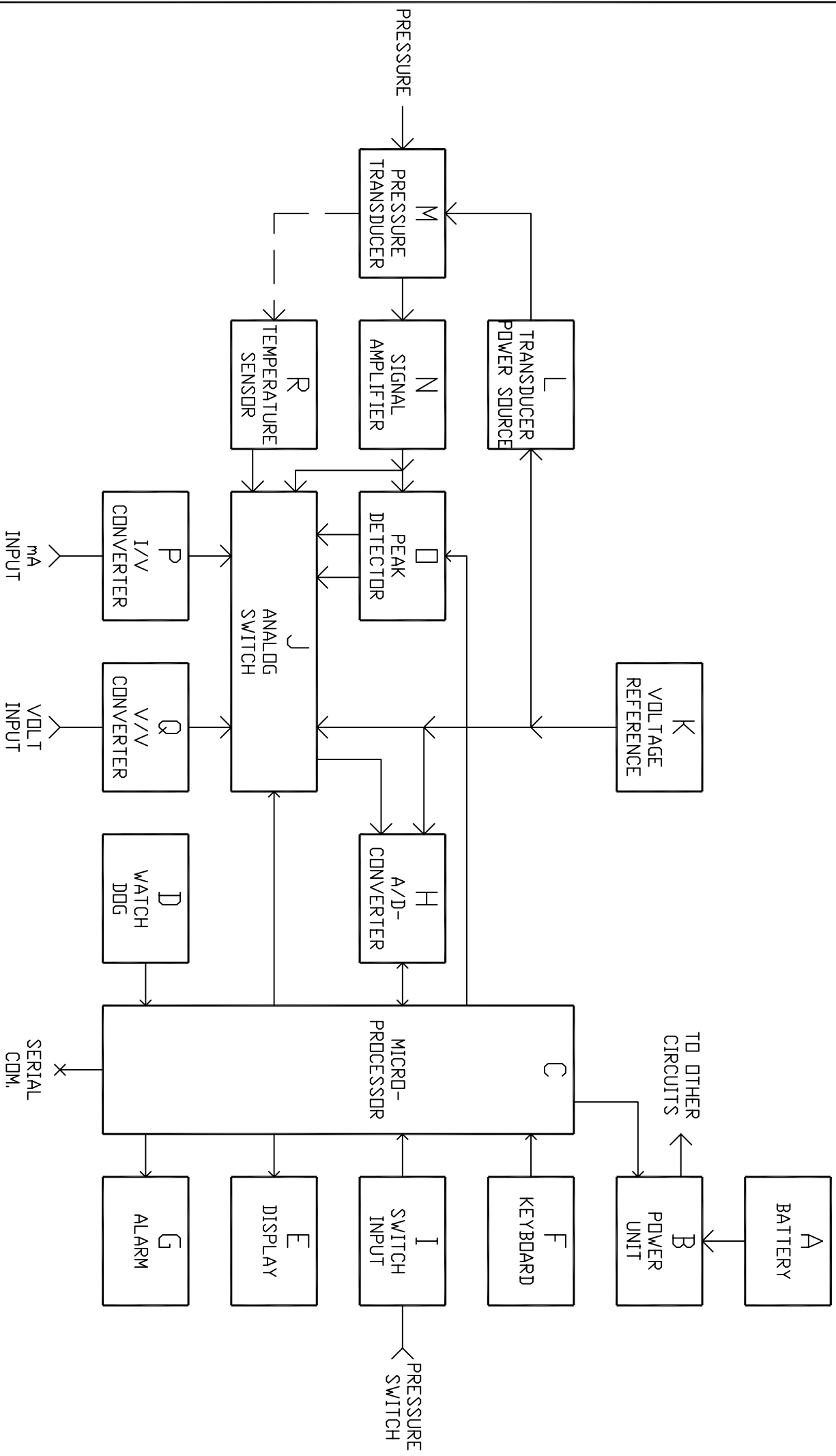
Before the program "PROM.EXE" is executed place a jumper on J13 and connect J2 to a 12 Volt DC supply which is switched off. Connect the voltage adapter to the interface connector (J6) and the PC on COM1. Remove the foil connector from the print connector (J1) and make a short circuit between pin 1 and 7. Execute the program and follow the instructions in the program. The RESET is done by making a short circuit on J14.


If the used CPU is former programmed and then erased, there might be some former calibration values in the EEPROM. In order to erase them, press down the softkeys <Mean/Peak> <Zero> <Units> and then switch on the calibrator. Then release the softkeys (<Units> should be the first released by the three). Enter the CODE and press the softkey <Hold-Reset> (see section 2.1.1, doc. no. 100313).

POS.	PART NO.	DESCRIPTION
		4.1 Spare parts MPC (Please see exploded view)
1	100449	Label, MPC 15 BAR / 200 PSI
1	100462	Label, MPC 140 BAR / 2000 PSI
2	100448	Keyboard, MPC
7	60-PPC02	Main board, complete
10	60C072	CPU
12	60V010	Screw 2.9 x 6.5 mm
13	65-V994	Connector for transducer
14	60R253	Transducer for 140 and 200 BAR
19	60V011	Screw M4 x 10 mm
24	60V027	Screw 3 x 25 mm
25	60C310	Temperature sensor
26	60V623	Screw M4 x 6 mm
27	101899	Spring leaf 7 x 24 x 0.4
29	60R262	Transducer for 15 BAR
30	60V005	See-ring, type J20
36	60D474	Filter board



Dok.	This drawing is the property of Ametek, it must not be used, copied or handed on to third parties without the express permission in writing. ©	** Change by cad-system only **	Materiale	Generelle tolerancer		Overfladebehandling	
			 GAMMELGÅRDSVEJ 87 3520 FARUM DENMARK TLF.: +45 42958800	—	Andre standarder		
				—			
				—			
				Målstok:	Tegner	Lineære mål	
				—	HTR	mm	
Emnebetegnelse	Exploded view Pressure calibrator		Dato:		Tegn. format		
			961106		A3		
			Ersatning for				
		Tegnings nr:		Rev nr.:			
		100319		01			



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SCALE	EDIT A	EDIT D					
DATE	EDIT B	EDIT E					
960223							
DRAWN	EDIT C	EDIT F					
LNK							
 JOFERA INSTRUMENTS GAMMELGIRDSVEJ 87 DK-3520 FARUM TLF.: 42958800				TITLE Pressure calibrator BLOCK DIAGRAM			
				DRAWING NO.		KEY NO.	PAGE
				100315		10031501	

